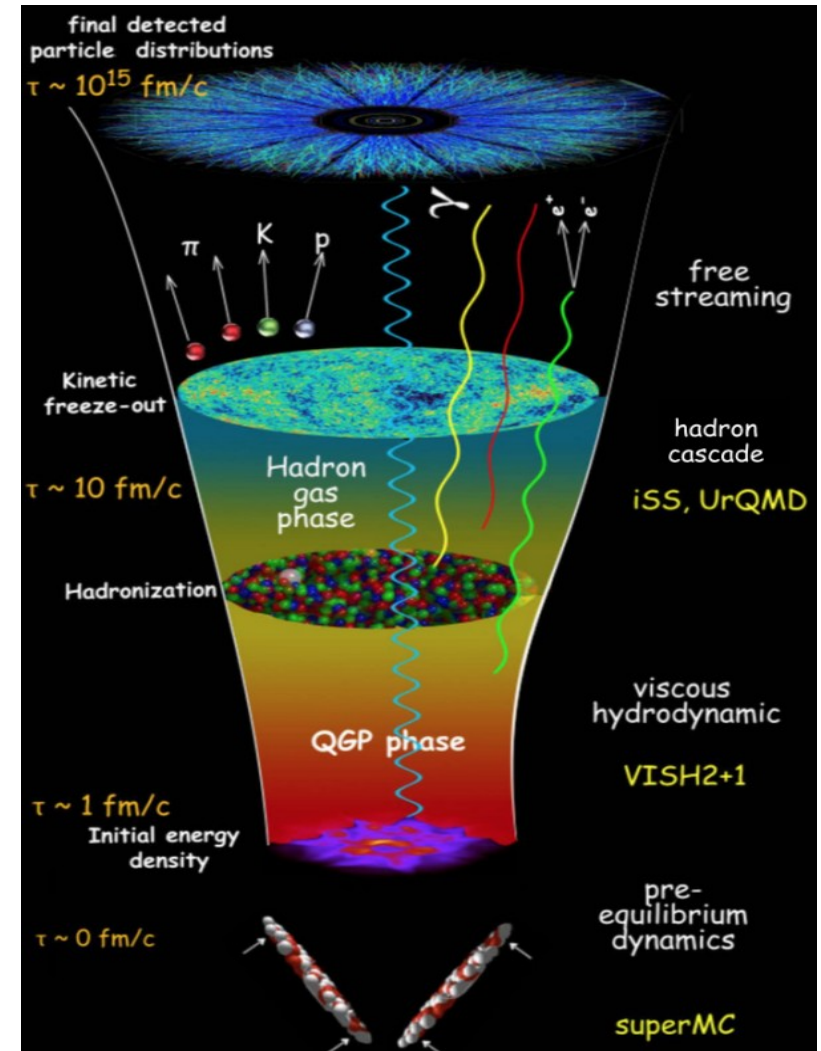
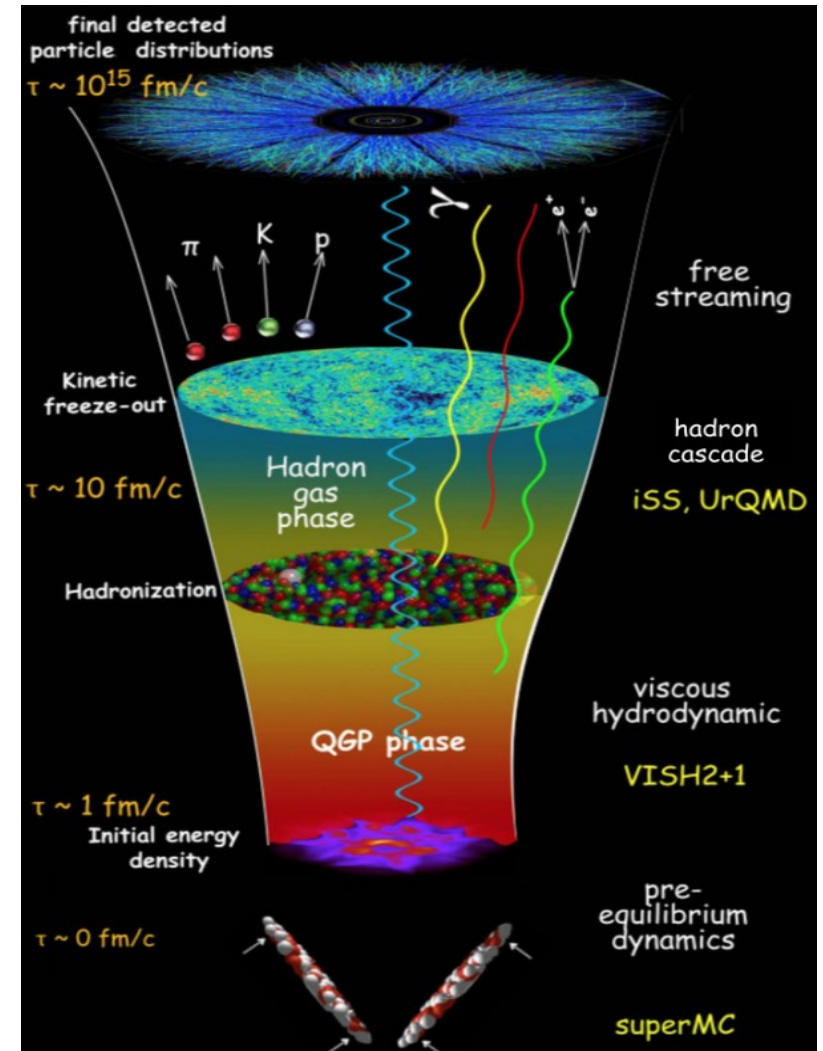
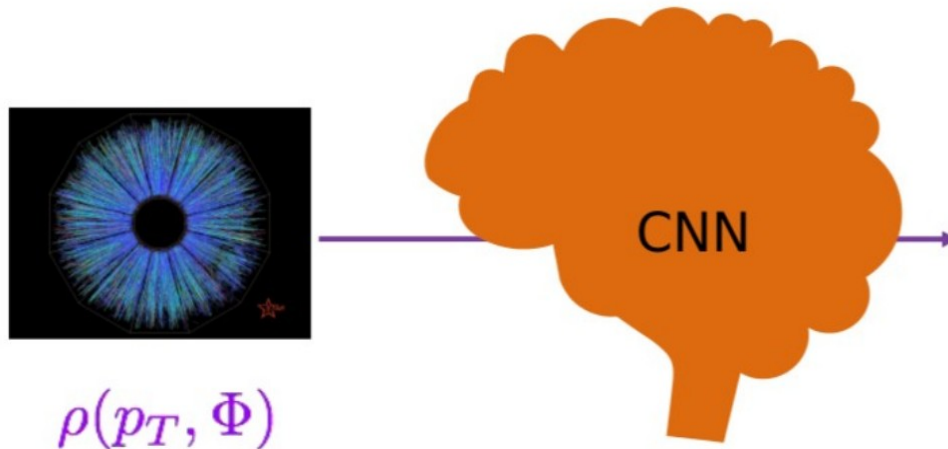


Standard HIC model - uncertainties

- Different physics factors entangled
- Only final hadrons/decays observed
- Encode early dynamics from final states?



Standard HIC model - DL helps



Following ups

**nature
communications**

Hydrodynamics Simulation

Article | [Open Access](#) | Published: 15 January 2018

An equation-of-state-meter of quantum chromodynamics transition from deep learning

Long-Gang Pang , Kai Zhou , Nan Su , Hannah Petersen, Horst Stöcker & Xin-Nian Wang

Nature Communications **9**, Article number: 210 (2018) | [Cite this article](#)

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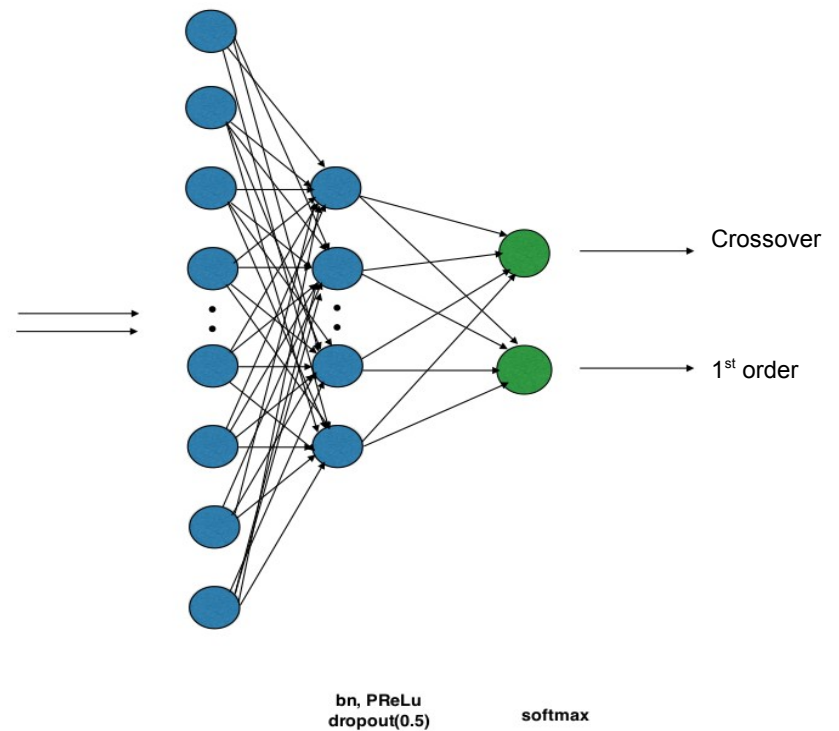
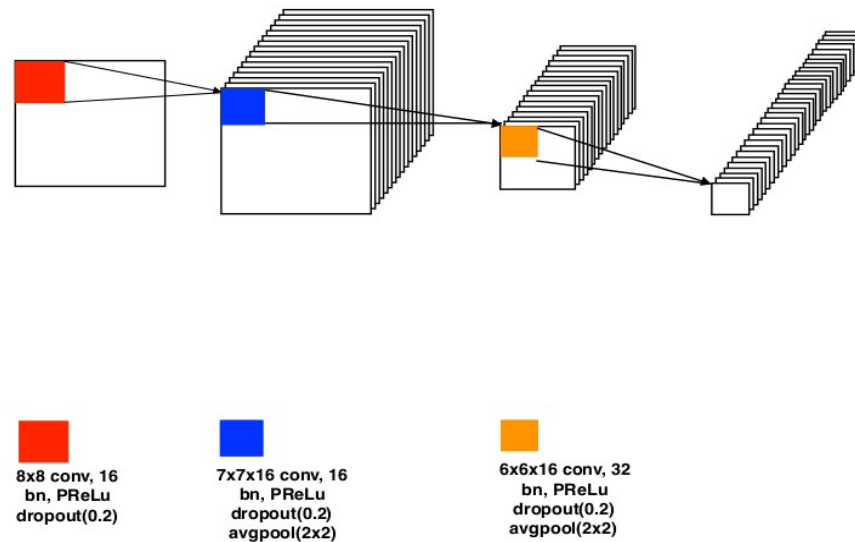
- → Hadronic Cascade (**hybrid**)
EoS classification
- → Non-equilibrium (**spinodal**)
baryon clumping detection
- → Detector Simulation (**tracks/hit**)
impact b regression @ CBM

EoS Classification with Hybrid model

The dataset is separated into **Train** and **Test** folders, where **Train** including both training set and validation set (randomly select 20% for validation).

In either folders there are two classes of data files: ***EOSL.zip*** and ***EOSQ.zip***, unzipping the file will release the pion spectra data (with different simulation parameters in different subfiles, details can go to Ref[2]), in each released pion spectra data file, the first 4 numbers of each line are useless (per spectra per line). Removing the first 4 numbers in every line, per line is a *flattened 24x24 two dimensional histogram of pion spectra*.

[2]Identifying the nature of the QCD transition in relativistic collision of heavy nuclei with deep learning, Yi-Lun Du, Kai Zhou, Jan Steinheimer, Long-Gang Pang, Anton Motornenko, Hong-Shi Zong, Xin-Nian Wang and Horst Stoecker, **arXiv:1910.11530**



1) hadronic cascade “afterburner” with **finite number of particles and resonance decays** are taken into account

2) **information about EoS** in early dynamics is **not swiped away** inside the final-state pion spectra – *perspective from deep CNN*

3) more stochasticity from resonance decays and elongated hadronic cascade can **diminish** the correlation between EoS and the final-state spectra

4) proper enhancement of statistics and reduction of fluctuations can **facilitate** the revealing of EoS information by deep CNN

